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UNITED STATES DEPARTMENT OF AGRICULTURE  
Agricultural Marketing Service  
Cotton Division

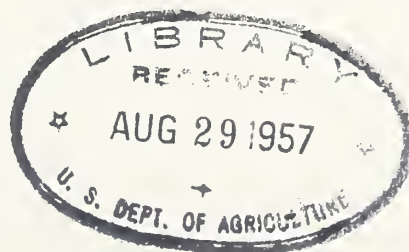
NOTES ON LAMP MAINTENANCE OF EXAMOLITE UNITS  
IN COTTON CLASSING ROOMS - MAY 1957

1. Lamp Inspection. Most offices seem aware of the need for daily or weekly inspection to see that all tubes and bulbs are burning in each unit, and that they are kept clean enough to keep the foot candle readings at all times up to the normal expected for each installation. This normal should be set by making a foot candle survey of each room when it is newly lamped, and then it should be maintained within a 20% limit of this normal. Since the inexpensive foot candle light meters in general use are not expected to be accurate within  $\pm 10\%$ , there often is considerable difference from one meter to another. But if readings in each room are made on the same meter these readings should be self-consistent.

2. Trouble with tubes fitting. For those classing rooms in which there still is trouble about lamps fitting, it is probable that somehow the fixture has been sprung out of shape. The screws that hold the tube sockets in place are on the outside of the fixtures. If the boxes are suspended in long rows, end to end, Mr. Meeker suggests that they may be sprung if the weight is not properly distributed and if so, it may be possible to correct this without taking the fixtures down, by loosening the bolts inserted to hold the fixtures end to end, and inserting a shim between the fixtures but in line with the plastic tube sockets. When the bolts are retightened this will force the ends of the fixtures in, or back to their original shape. A shim made of pressed fiber would be suitable, probably 2" wide and 18" long to fit. The thickness of the shim may vary, depending upon how badly the box is sprung.

For lamps hung so that the end screws may be reached, the screws can be loosened, and a fiber shim inserted directly behind the individual socket. If neither of these methods works, then unfortunately the boxes must be lowered, at least every other one, so that the end screws may be reached to loosen the socket and insert individual shims. Tubes are all the same length, so it has to be the fixture. (Recently it was suggested to Macbeth - through Mr. Reese - that it would save a lot of trouble if they would weld the screws in from the outside, and fasten them with nuts on the inside - but, this will be too late for fixtures already installed.)

3. Ballasts. Under normal conditions of installation ballasts should last at least 10 or 15 years. Heat is a major factor in determining their life, which means that units mounted in flush ceilings with limited space for ventilation may have a shorter life than those with sufficient ventilation.





4. Variation in lamp life. The rated life of fluorescent tubes is 7500 hours. Tests on fluorescent tubes that are made by the manufacturers of Examolite tubes show, on a 3-hour burning cycle, that after 7500 hours lamps still retain 84% of their original lumen output. On a longer cycle (as when turned on and off only once a week) the lumen output holds up even better.

One of the things that may be causing differences in light output, in rate of lumen loss, and of burnouts, in our various offices may be temperature. At 120° ambient (surrounding) temperature lamps operate at only about 80% lumen efficiency. Therefore, lack of ventilation above a furred ceiling, in which the air gets hot and stays hot around the lamps, may be one cause of trouble. Acoustical ceilings will hold the heat even more than some other types. Perhaps our specifications, when hanging lamp units in a flush ceiling, should in future provide for a minimum space above the units and in addition should make provision for ventilation, either natural or forced. Ventilator openings at each end of the rows might help, and at least 4 inches or more clearance above the lamp units to the ceiling, with or without a fan to move the air.

Lamp life is rated on operation around 115-118 volts, and if the voltage on the lines operating the lamps should vary more than 10% above or below this level, it could well affect the life of lamps and ballasts. Even when the main line carries sufficient voltage, it is possible that the line used for the lamps could be overloaded. If such a condition exists, it should be remedied.

5. Relamping. More and more we believe that it will aid in standardization and in uniformity of lighting, to use only Examolite tubes and Examolite bulbs in relamping. The Examolite fluorescent tube is made by one manufacturer under highly standardized conditions. The Examolite incandescent bulb is especially made to provide long life so that constant replacement of burned out bulbs will not be necessary. The 25-watt incandescent bulbs formerly used have a rated life of 1000 hours, and this is why they burned out so much faster than the 7500-hour tubes. But the Examolite incandescent bulbs are rated for 5000 hours.

Since 52 weeks of 40-hour operation would provide 2080 hours of burning, and since all of our classing rooms are not operated on a 52-week basis, there will be some difference in the time that seems best for relamping. But in any case there seems considerable advantage to relamping at one time, before the beginning of a new season. Because of loss of light output with age of burning, as well as increase in burnouts to be expected, it seems convenient to consider 5000 hours as a good goal before relamping. This could mean establishment of a relamping schedule about every three years except for rooms used over 40 hours per week throughout the year. This relamping schedule should depend upon the hours of lamp operation. As can be seen, lamps properly installed to operate under average conditions, can operate for a considerable length of time.

The cost of completely relamping each unit with Examolite tubes and bulbs is \$6.31 (4 tubes @ \$2.25, plus 4 bulbs @ \$0.40 each, less 40-1/2% for government lamp discount).

It is suggested that each Area office set up a relamping schedule with the offices in its area, arranging each year to purchase at one time lamps enough to relamp those offices that need it, and that this be done prior to the beginning of the season. A few spares should also be provided for each office to replace any small number of accidental burnouts in the months intervening between relamping. Not over 5% of the full supply should be needed for this purpose.

As for starters, about the same number of spares should be available as for lamps. If these are bought locally Miss Nickerson suggests using Sylvania 40-watt starters, for they have ceramic condensers that make them outlast the lamps.

As for ballasts, it takes an electrician to replace a ballast, but we should make sure that replacements are made with good quality ballasts of the correct type, depending upon whether the units use preheat or rapid-start lamps. Because there have been improvements in the Macbeth unit since its earliest installations in the Cotton Division, some of our units require three 40-watt and two 20-watt tubes with 4 incandescent bulbs, and the newer ones require four 40-watt rapid-start tubes plus 4 Examolite incandescent bulbs. The new tubes can be used in all units, but any old supply of tubes we may have cannot be used in the newer fixtures. With the new units, designed for rapid-start lamps, no starters are needed, and the ballast is different.

Since October 1956 Examolite fluorescent tubes are marked DeLuxe Examolite. While the new tube looks like the old one, its color correction throughout the spectrum has been improved, and it is rapid-start instead of preheat. The leaflet attached gives a series of spectral curves showing the improvement that has been made. The spectral curve of the C4-D Examolite is now as close, Miss Nickerson says, to that of daylight at the standard color temperature of 7500K, as it seems likely we can get with a fluorescent lamp. This is additional reason, when we need to relamp, to do so with Examolite tubes and bulbs.

We have provided the best lighting we can in our classing rooms. Now let us see that all of our offices maintain this as uniformly and as near to standard as is possible.

Attachment

Agri-Wash





*Announcing ...*

**the  
first  
major  
lighting  
development  
for  
viewing  
color ...**

**in**

**8  
YEARS**

**to**

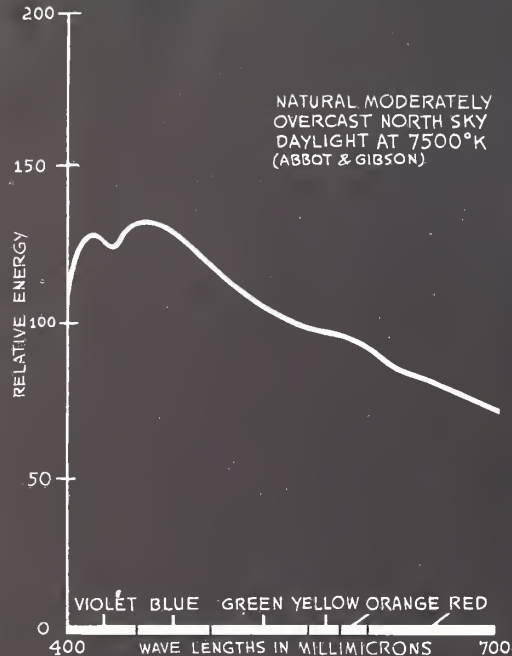
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**color**

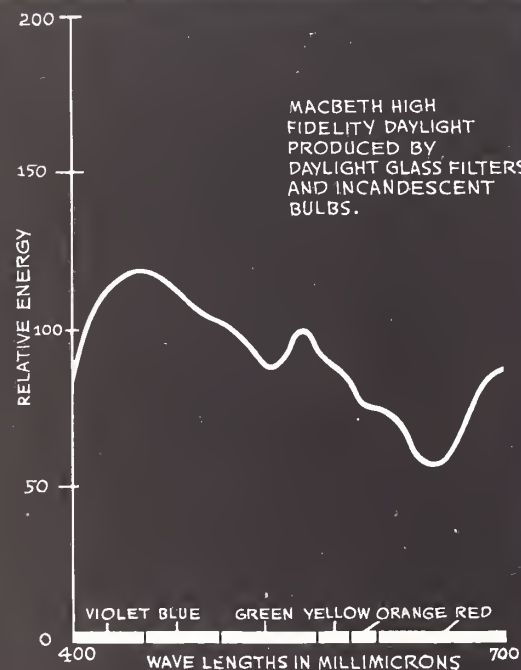
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**Macbeth**

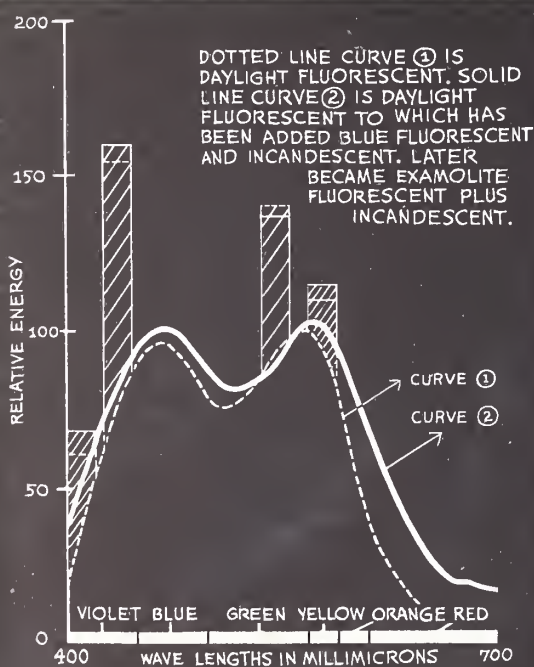
**MACBETH**



Curve A



Curve B



Curve C

In order to tell you best about this exciting new lighting development a brief historical review seems appropriate.

Man has been striving to reproduce natural daylight since the invention of electric light sources. In the field of industrial color matching, shading, grading, and inspection a specific type of daylight is preferred and required by the colorist. Graph (A) shows the color distribution of the light radiating from a moderately overcast north sky. This is the ultimate standard with which electric light sources are compared to determine how well the electric source can be substituted for the natural one.

Since **1915** Macbeth lighting engineers have been producing and standardizing the world's closest duplication of north sky daylight by the use of daylight glass conversion filters together with incandescent lamps. The color distribution of Macbeth filtered daylight is shown in Graph (B), which when compared with Graph (A) will show the closeness of duplication. Macbeth filtered high-fidelity daylight continues today to be the most accurate duplication of daylight and is recommended for critical industrial color matching of pigments, dyes and colorants.

There are many other *less critical* industrial color problems where good color corrected illumination is

required. When the first daylight fluorescent tube was announced it was soon found that this light source was unsatisfactory for both critical color matching and routine color inspection applications. The reason for this can be seen from Curve I, Graph (C). Note the low violet-blue content and almost complete absence of red as compared to Graphs (A) and (B). The mercury spectrum lines also are present introducing further color distortion.

In **1949** Macbeth announced the original Examolite fixture. The color distribution of the light produced in the Examolite is shown in Graph (C) Curve Two. The original Examolite color corrected to a degree the basic daylight fluorescent tube and was done by adding blue and red, which can be seen from the curves. Thus, a blend of 3-40 watt daylight fluorescent tubes, 2-20 watt blue tubes, and 4-25 watt incandescent bulbs (for the red additive) were used with a sandblasted diffusing glass to insure complete mixture.

In **1952** Macbeth improved the original Examolite by announcing the new water white 63-64 crista-lite diffusing glass. This new glass tended to reduce the effect of the blue streak caused by the blue fluorescent tubes in addition to transmitting more light. Maintenance was reduced as the glass could be washed with soap and water. *This was a mechanical improvement but no change in light color quality (same as Graph (C) Curve Two).*

In **1953**, because various brands of daylight fluorescent tubes were vastly different in color, resulting in an urgent necessity for color standardization, Macbeth announced the color quality controlled Examolite fluorescent tubes in both 20 and 40-watt sizes. The Examolite tube combined into a single tube the two fluorescent colors, namely, daylight and blue, and thereby completely eliminated the blue streak. Users could relamp without making their fixtures obsolete. *This was a change in appearance and assured standardization, with no change in color (same as Graph (C) Curve Two).*

Early in **1956** Macbeth announced the long-life Examolite incandescent bulb, which fits into the same socket. This reduced the bulb relamping cost per fixture by 65% and improved standardization. The regular bulbs had a life of 750 hours, and many Examolite fixtures were operated with the incandescent bulbs burned out (loss of red correction). The Examolite bulbs have a life of 5,000 hours, therefore assuring maintenance of the blend during the life of the Examolite tubes, and relamping is done only once and all at once. In addition we incorporated into new fixtures constant voltage ballasts, so the light and color output of the tubes would remain constant even though the line voltage varied. *These changes were electrical and assured better standardization, but no change in color quality (same as Graph (C) Curve Two).*

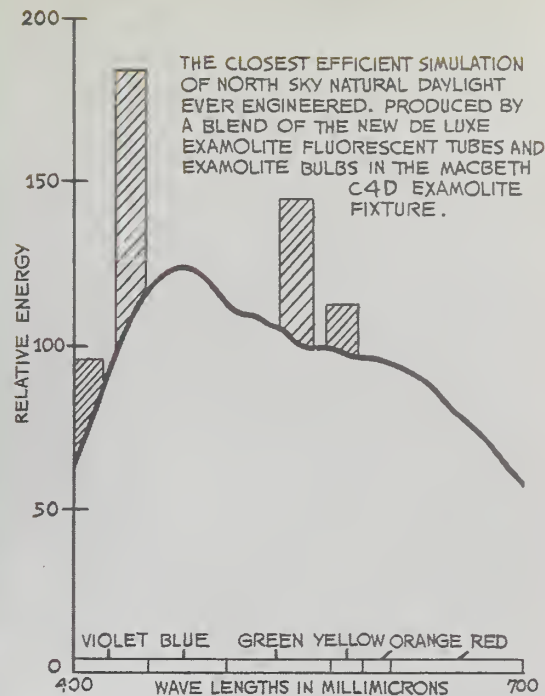


# Now... we announce Type C4-D Examolite®

This fixture represents a culmination of 8 years of engineering development and the ultimate in a standardized, color corrected light source sufficiently simulating daylight for all industrial color inspection applications.



**new**



**Curve D**

Graph (D) shows the color distribution of the light produced in the type C-4D Examolite fixture. A glance at this curve as compared to the others will, we believe, provide you with the reason why we are so excited here at Macbeth. Note how good the color correction is in all regions of the color spectrum. The mercury lines are still present and are inherent in all fluorescent light sources; therefore, we can not technically call this light a duplication of daylight, but we can say that *it is the best low cost, economical simulation of daylight that has ever been engineered.* We do not see how more improvement can be made. This will be the standard for years to come.

The new C-4D fixture features:

- (a) New Deluxe Examolite tubes. 4-40 watt F40T12/EX.X
- (b) Long-life Examolite bulbs. 4-33 watt 33WA19/EX
- (c) Efficient and easy to maintain crista-lite 63-64 diffusing glass.
- (d) Constant voltage ballasts.

This combination of high quality controlled components produces the light quality shown in Graph (D). Now you can buy Examolites with assurance that you will obtain the best color corrected illumination ever made available and at a low price. Fill out the enclosed Engineering Survey Form, and we will send you full information at no cost.

If you own Examolite fixtures and want to modernize your equipment, why not put in the new tubes, bulbs and diffusing glass? Write us stating how many fixtures you wish to bring up-to-date, and we will send you full information.

*Shown at right, Macbeth Examolite fixtures used for production color uniformity inspection of appliances (above) and over graphic arts proof tables (below).*





For critical color matching of colorants, pigments and dyes, Macbeth high-fidelity daylight lamps, Models BBX-826 and BX848A, are recommended. For industrial color inspection problems such as:

- (a) Grading of agricultural products.
- (b) Graphic arts press table illumination.
- (c) Shading of textile materials.
- (d) Inspection of appliances.

the new Macbeth type C-4D Examolite fixture is recommended.

Bear in mind, that your color matchers and color inspectors can only correct the colors that they can see. If the color is not present in the light source to begin with, then it can not be seen by your colorist and, therefore, will not be properly corrected. The complete line of Macbeth lighting equipment for critical color matching and industrial color inspection features complete color content of the light source, assuring you that color differences in your products can be seen, and, therefore, corrected.

*Today, you can take advantage of this new lighting development for your PRODUCTION color inspection, shading and grading lighting requirements (Curve D).*



*Examolite fixtures being used for production textile perching and color inspection*

We invite you to fill out the enclosed Engineering Survey Form and Macbeth engineers will make recommendations concerning the proper lighting equipment to assist you in solving your color problem.

**SOME  
APPLICATIONS  
FOR  
MACBETH HIGH FIDELITY  
FILTERED DAYLIGHT  
(CURVE B)  
page 2**

For critical color matching of pigments, dyes or colorants, prior to production, we recommend Macbeth Skylights in such industries as:

Paints  
Plastics  
Leathers  
Coatings  
Cosmetics

Paper  
Textiles  
Inks  
Agricultural Products  
Graphic Arts

Ceramics  
Metals  
Gems  
Furs  
Roofing

# MACBETH

**MACBETH DAYLIGHTING CORP.**  
A Subsidiary of the Macbeth Corp.  
Newburgh, New York

**To see Color...see Macbeth!**





